IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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Inventor:	Jacob et al.			
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Customer No.:	24737			

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

November 9, 2009

APPEAL BRIEF

Dear Sir:

     Attached herewith is an Appeal Brief pursuant to 35 U.S.C. §134 and 37 C.F.R. §41.37 for the above-identified patent application in support of a Notice of Appeal filed with the United States Patent and Trademark Office on September 16, 2009.

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I. REAL PARTY IN INTEREST

The real party in interest in the above-entitled application is Koninklijke Philips Electronics N.V., Eindhoven, NL.

II. RELATED APPEALS AND INTERFERENCES

The undersigned attorney/agent, the appellant, and the assignee are not aware of any related appeals or interferences that would directly affect, or be directly affected by, or have a bearing on the Board's decision in this pending appeal.

III. STATUS OF THE CLAIMS

Claims 1-12 and 14-21 are pending and are all on appeal. Claims 1-12 and 14-21 stand rejected. Claims 1-3, 5-12 were amended, claim 13 was cancelled and claims 14-21 were added during prosecution.

IV. STATUS OF AMENDMENTS

No after final amendments have been submitted.

V. SUMMARY OF THE CLAIMED SUBJECT MATTER

Claim 1 is directed towards an image processing system 150 for displaying information relating to the amplitude of displacements (page 4, line 31) of wall regions of a deformable 3D object under study (page 4, line 16; page 5, lines 5-6), with the system comprising: acquisition means (page 9, lines 34-35) for acquiring image data of an image sequence (page 9, line 35) of the 3D object under study; processing means 120 (see also page 5, line 19) for processing the 3D object data in the images of the sequence by locating the 3D object wall (page 5, line 26-27), defining regions of interest on the 3D object wall (page 7, lines 27-29), and processing the image data of the 3D object wall to determine the amplitude of displacement (page 6, line 16 to page 7, line 21) of each of the regions of interest as a

function of time, constructing a first 2D simplified representation 20.A of the 3D object wall (page 8, line 6-8) by projection of the 3D object wall along an axis, comprising the projections of the regions of interest as a function of time (Figure 3; page 7, line 32 to page 8, line 8); and display means (page 8, lines 12-14) for displaying indications of the amplitudes of displacement of each of the regions of interest of the 3D object wall in the respective projections of the regions of interest (page 8, lines 16-19), called segments, in the constructed 2D simplified representation 20.A.

Claim 2 depends from claim 1, and requires that the means for constructing the first 2D simplified representation (page 5, lines 9-11), called 2D simplified amplitude representation 20.A (page 8, lines 32-35), provide indications of amplitudes that are indications of the maximal and minimal amplitudes of displacements of the regions of interest over a period of time.

Claim 3 depends from claim 2, and requires that the image processing system 150 of claim 2 further comprises means for constructing a second 2D simplified representation of the 3D object wall (page 5, lines 9-11), similar to the first 2D simplified representation of the 3D object wall, and with similar projections of the regions of interest, called segments, this second 2D simplified representation being called 2D simplified phase representation 20.B; and displaying indications of the instants of time at which the maximum or minimum of amplitudes of displacements occur in the regions of interest, over said period of time, in the 2D simplified phase representations (page 8, line 36 to page 9, line 2).

Claim 4 depends from claim 3, and requires that the image processing system 150 of claim 3 comprise means for displaying the 2D simplified amplitude representation 20.A and the 2D simplified phase representation 20.B together in a same image (page 9, lines 4-8).

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Claim 5 depends from claim 4, and requires that the image processing system 150 of claim 4 comprise means to display the values of amplitude and of time in the respective 2D simplified amplitude representation 20.A and the 2D simplified phase representation 20.B indicated in a color-coded manner (page 8, lines 33-34; page 9, line 1).

Claim 6 depends from claim 1 and further recites means to display indications of the amplitudes of displacement 20.A of the regions of interest of the 3D object wall in the respective projections of the regions of interest (see page 9, lines 4-8), called segments (see Fig. 1A), in the constructed 2D simplified representation 20.B. The segments are displayed in a color-coded manner (page 4, lines 31-32; page 8, lines 33-34; page 9, line 1). Also, the indications of the amplitudes of displacement 20.A change in the segments at the rate of the images of the sequence (see page 9, lines 22-24), so as to form an animated 2D simplified representation 20.B as a function of time (see page 9, lines 22-27).

Claim 7 depends from claim 1 and further requires displaying the 2D simplified representations of the 3-D object wall as 2D bull's eye representations 20.A, 20.B (see page 9, lines 4-27).

Claim 8 depends from claim 1 and requires that the object under study is the heart left ventricle and the regions of interest include the internal boundary of the left ventricle wall (see page 4, lines 16-17).

Claim 9 depends from claim 1 and requires that the processing means 120 (see also page 5, line 19) for locating the 3D object wall (page 5, line 26-27) are a segmentation means (see page 5, lines 26-29; see also Fig. 1A) for operating a segmentation technique applied to the 3D object under study (see page 5, lines 26-29). The segmentation means include using a mesh model technique and reshaping the mesh model for mapping said mesh model onto the wall of the 3D object under study (see page 5, lines 30-34; see also Fig. 1A), so as to provide

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a simplified volume with a wall (see page 6, lines 8-11; see also Figs. 1B-1D), called an object wall, that is the object of interest (see page 6, lines 8-15).

Claim 10 recites a system 120 comprising a suitably programmed computer or a special purpose processor having circuit means, which are arranged to process image data as claimed in claim 1 (see page 10, lines 1-4). Claim 10 further requires means to display the processed images (see page 9, lines 36-40).

Claim 11 is directed towards an image processing method for processing ultrasound image data and for displaying an ultrasound image of a deformable 3-D organ (page 4, line 16; page 5, lines 5-6) with indications of the organ wall motions, comprising steps of acquiring image data of an image sequence for locating the 3D object wall (page 9 line 35), defining regions of interest on the segmented 3D organ wall (page 7, lines 27-29), and processing the image data to determine the amplitude of displacement of each of the regions of interest as a function of time (page 5, lines 26-27); constructing a first 2D simplified representation of the 3D segmented organ wall 20.A by projection of the 3D simplified representation (page 7, line 32 to page 8, line 8); and displaying indications of the amplitudes of displacement of the regions of interest of the 3D segmented organ wall in the respective projections of the regions of interest (page 7, lines 27-29), called segments (see Fig. 1A), in the constructed 2D simplified representation, in a color coded manner (page 8, lines 16-19; page 8, lines 33-34; page 9, line 1).

Claim 16 is directed towards a computer readable storage medium 130 which contains computer readable instructions for processing ultrasound image data and for displaying an ultrasound image of a deformable 3D organ with indications of the organ wall motions (see page 9, line 36 to page 10, line 1). The instructions cause the image processing device to first acquire image data of an image sequence of the organ (see page 9, line34-36). The instructions then cause the processing device to segment the 3D organ in the images of the

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sequence for locating the 3D object wall (page 5, line 26-27), and defining regions of interest on the segmented 3D organ wall (page 7, lines 27-29). Lastly, the instructions cause the imaging processing device to process the image data to determine the amplitude of displacement of each of the regions of interest as a function of time (see page 5, lines 26-27).

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Whether claims 11, 12, 14 and 15 fall within one of the four statutory categories of invention under 35 U.S.C. §101.

Whether claims 1-11, 14, 17-18 and 20-21 are unpatentable under 35 U.S.C. §103 over Metaxas (US 6,295,464) in view of Ryals et al (US 5,803,914).

Whether claims 16 and 19 are anticipated under 35 U.S.C. §102 by Metaxas (US 6,295,464).

VII. ARGUMENTS

A.   Rejection of Claims 11, 12, 14 and 15 under 35 U.S.C. §101

Claims 11, 12, 14, and 15 stand rejected under 35 U.S.C. 101. In particular, the Office asserts that the claims recite a method process that is not tied to a particular machine. However, method claims 11, 12, 14, and 15 are tied to a particular machine as independent claim 11 states that the limitations therein are performed by an image processing system and claims 12, 14, and 15 depend therefrom. As such, the rejection of these claims should be reversed.

B.   Rejection of Claims 1-11, 14, 17-18 and 20-21 Under 35 U.S.C. §103

Claims 1-11, 14, 17-18 and 20-21 are rejected as being unpatentable under 35 U.S.C. §103(a) over Metaxas and further in view of Ryals et al. This rejection should be reversed because the combination of Mextaxas and Ryals et al. does not teach or suggest all the

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limitations of the subject claims and, therefore, fails to establish a *prima facie* case of obvious with respect to the subject claims.

> The rationale to support a conclusion that the claim would have been obvious is that all the claimed elements were known in the prior art and one skilled in the art could have combined the elements as claimed. *KSR International Co. v. Teleflex Inc.*, 550 U.S. 398 (2007). MPEP §2143

> "To support the conclusion that the claimed invention is directed to obvious subject matter, either the references must expressly or impliedly suggest the claimed invention or the examiner must present a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references." *Ex parte Clapp*, 227 USPQ 972, 973 (Bd. Pat. App. & Inter. 1985). MPEP §706.02(j).

Metaxas

Metaxas is directed towards a method and apparatus for dynamically modeling an object, involving receiving signals from a sensor which corresponds to points within the object. A volumetric model is provided which represents the object and any motion changes within the object. These motion changes are determined by an estimation method.

Claims 1 and 11

Independent **claim 1** recites an image processing system for displaying information relating to the amplitude of displacements of wall regions of a deformable 3D object under study, the system comprising, *inter alia*: processing means for processing the 3D object data in the images of the sequence *for locating the 3D object wall by defining regions of interest on the 3D object wall* and *processing the image data of the 3D object wall to determine the amplitude of displacement of each of said regions of interest as a function of time.* The processing means further *construct a first 2D simplified representation of the 3D object wall by projection of the 3D object wall along an axis, with the projections of the regions of*

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interest in said 2D simplified representation. The combination of Metaxas et al. and Ryals et al. fail to teach or suggest the above-emphasized claim elements.

More particularly, in response to Applicants' previous arguments in the Final Office Action dated June 16, 2009, the Office asserts that Metaxas et al. at Figure 4, col. 9, lines 44-61 and col. 4 lines 40-60 to teaches identifying the 3D object wall by identifying regions of interest *within* the 3D wall. First, claim 1 recites defining regions of interest *on* a 3D object wall, and not *within* a 3D wall. Next, the cited sections of Metaxas et al. actually only disclose defining regions of interest (volume elements 201-203) *inside* vessel walls (and then tessellating or juxtaposing the regions of interest to one another so that their triangular faces 204, 205 reach the walls) (see Figure 4; col. 9, lines 49-51). However, the cited sections of Metaxas et al. do not teach or fairly suggest defining regions of interest *on* a 3D object wall as required in claim 1. Therefore, Metaxas et al. fails to teach or suggest the claim element.

Further in response to Applicants' previous arguments in the Final Office Action, the Office asserts that Figures 9a-c, and col. 12, lines 45-62 of Metaxas et al. teach identifying a *change in displacement* for the 3D object wall. However, claim 1 recites processing the image data of the 3D object wall to determine an *amplitude of displacement* of each of the said regions of interest as a function of time. In the cited sections, Metaxas et al. generally discloses a model at two time intervals (see col. 9, lines 46-47). Figure 9a discloses translation at two different times, which may be arbitrary, based on the location of the origin (see col. 9, lines 54-56). Figure 9b discloses that where translation and a longitudinal contraction may show correct motion, the longitudinal contraction may lose its intuitive meaning, also depending on the location of the origin (see col. 9, lines 56-62). Figure 9c, likewise, discloses motion where there are sparse data points. In this occurrence, global translation may be kept constant for subsequent time frames and a displacement may be calculated using equation 18 (see col. 9, line 63 to col. 10, line 4). Metaxas et al., however, is silent regarding determining an *amplitude* for any displacement calculated in Figure 9c. As such, Metaxas et al. fails to teach or suggest determining the amplitude of displacement as recited in claim 1.

Further in the response to Applicants' previous arguments in the Final Office Action, the Office asserts that Figures 9a-c, col. 12, lines 28-67 and col. 13, lines 1-18 of Metaxas et al. teach projecting a 3D object wall as a 2D representation. Contrary to this assertion, claim 1 recites constructing *a first 2D simplified representation* of the 3D object wall *by projection of the 3D object wall along an axis, with the projections of the regions of interest in the 2D simplified representation*. In the referenced sections, Metaxas et al. discloses examples of changing a first model to a second model based on contraction and translation of the left ventricle (see Figures 9a-c). Metaxas et al. also discloses using two sets of data to estimate 3D motion, long-axis data and short axis data (see col. 13, lines 47-50). Particularly, Metaxas et al. discloses using 50 sets of 2D images containing time-varying points (see col. 13, lines 56-57). Metaxas et al. discloses changing a first 3D model to a second 3D model. However, Metaxas et al. is silent regarding then constructing a *2D simplified representation by projecting the 3D object wall along an axis, with the projections of the regions of interest*. Therefore, Metaxas et al. fails to teach or suggest the subject claim element.

Ryals et al. fails to make up for the above noted deficiencies of Metaxas et al. Accordingly, the rejection of claim 1, under the combination of Metaxas et al. and Ryals et al., should be reversed.

Claim 11 recites aspects similar to those recited in claim 1. As such, the arguments made with respect to claim 1 apply *mutatis mutandis* to claim 11. Hence, the rejection of claim 11 should be reversed.

Other Claims

Claims 2-10, 14 depend from claims 1 and 11, respectively, and are allowable at least by virtue of their dependencies. As such, the rejections of claims 2-10 and 14, 17-18 and 20-21 should be reversed.

Claims 17-18 and 20-21 depend from claim 16, subsequently discussed, and are allowable at least by virtue of their dependencies. As such, the rejections of claims 17-18 and 20-21 should be reversed.
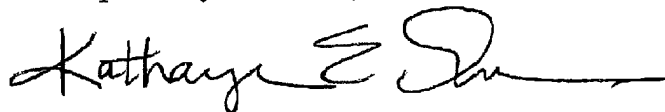
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C.   Rejection of Claims 16 and 19 under 35 U.S.C. §102

Claims 16 and 19 stand rejected under 35 U.S.C. 102(b) as being anticipated by Metaxas. This rejection should be withdrawn because **claim 16** recites aspects similar to those recited in claim 1. As such, the arguments made with respect to claim 1 apply *mutatis mutandis* to claim 16. **Claim 19** depends from claim 16 is allowable at least by virtue of this dependency. As such, the rejection of claim 19 should be reversed.

CONCLUSION

In view of the foregoing, it is submitted that claims 1-12 and 14-21 distinguish patentably and non-obviously over the prior art of record, and reversal of the rejection of claims 1-12 and 14-21 is respectfully requested.

Respectfully submitted,

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VIII. CLAIM APPENDIX

1. (Previously presented) An image processing system for displaying information relating to the amplitude of displacements of wall regions of a deformable 3D object under study, the system comprising:

acquisition means for acquiring image data of an image sequence of the 3D object under study;

processing means for:

processing the 3D object data in the images of the sequence for locating the 3D object wall, defining regions of interest on the 3D object wall, and processing the image data of the 3D object wall to determine the amplitude of displacement of each of said regions of interest as a function of time; and

constructing a first 2D simplified representation of the 3D object wall by projection of the 3D object wall along an axis, comprising the projections of the regions of interest in said 2D simplified representation; and

display means for displaying indications of the amplitudes of displacement of each of the regions of interest of the 3D object wall in the respective projections of said regions of interest, called segments, in said constructed 2D simplified representation.

2. (Previously presented) The image processing system of claim 1, wherein the means for constructing this first 2D simplified representation, called 2D simplified amplitude representation, provides indications of amplitudes that are indications of the maximal or minimal amplitudes of displacements of the regions of interest over a period of time.

3. (Previously presented) The image processing system of claim 2, further comprising means for:

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constructing a second 2D simplified representation of the 3D object wall, similar to the first 2D simplified representation of the 3D object wall, and with similar projections of the regions of interest, called segments, this second 2D simplified representation being called 2D simplified phase representation; and

displaying indications of the instants of time at which the maximum or minimum of amplitudes of displacements occur in the regions of interest, over said period of time, in said 2D simplified phase representation.

4.   (Original) The image processing system of claim 3, comprising means to display the 2D simplified amplitude representation and the 2D simplified phase representation together in a same image.

5.   (Previously presented) The image processing system of claim 4, comprising means to display the values of amplitude and of time in the respective 2D simplified amplitude representation and the 2D simplified phase representation indicated in a color-coded manner.

6.   (Previously presented) The system of claim 1, comprising means to display indications of the amplitudes of displacement of the regions of interest of the 3D object wall in the respective projections of the regions of interest, called segments, in said constructed 2D simplified representation, in a color-coded manner, the indications of the amplitudes of displacement changing in the segments at the rate of the images of the sequence, so as to form an animated 2D simplified representation as a function of time.

7.   (Previously presented) The image processing system of claim 1, comprising means to display the 2D simplified representations of the 3-D object wall as 2D bull's eye representations.

8.   (Previously presented) The image processing system of claim 1, wherein the object under study is the heart left ventricle and the regions of interest include the internal boundary of the left ventricle wall.

9.   (Previously presented) The image processing system of claim 1, wherein the processing means for locating the 3D object wall is a segmentation means for operating a segmentation technique applied to the 3D object under study, which includes using a mesh model technique, and reshaping the mesh model for mapping said mesh model onto the wall of the 3D object under study, so as to provide a simplified volume with a wall, called object wall, that is the object of interest.

10.   (Previously presented) A system comprising a suitably programmed computer or a special purpose processor having circuit means, which are arranged to process image data as claimed in claim 1, and having means to display the processed images.

11.   (Previously presented) An image processing method for processing ultrasound image data and for displaying an ultrasound image of a deformable 3-D organ with indications of the organ wall motions, wherein the method is performed by an image processing system, comprising steps of:

acquiring image data of an image sequence of the organ under study, segmenting the 3-D organ in the images of the sequence for locating the 3D object wall, defining regions of interest on the segmented 3D organ wall, and processing the image data to determine the amplitude of displacement of each of said regions of interest as a function of time;

constructing a first 2D simplified representation of the 3D segmented organ wall by projection of the 3D segmented organ wall along an axis, comprising the projections of the regions of interest in said 2D simplified representation; and

displaying indications of the amplitudes of displacement of the regions of interest of the 3D segmented organ wall in the respective projections of the regions of interest, called segments, in said constructed 2D simplified representation, in a color coded manner.

12.   (Previously presented) The method of claim 11, comprising steps of:
displaying indications of the maximal or minimal amplitudes of displacement of each of the regions of interest, over a period of time, this first 2D simplified representation being called 2D simplified amplitude representation;

constructing a second 2D simplified representation of the 3D segmented organ wall, similar to the first 2D simplified representation of the 3D segmented organ wall, and with similar projections of the regions of interest, called segments, this second 2D simplified representation being called 2D simplified phase representation; displaying indications of the instants of time at which the maximum or minimum of amplitudes of displacements occur in the regions of interest, over a period of time, in said 2D simplified phase representation; and

displaying the 2D simplified amplitude representation and the 2D simplified phase representation in a same image at the same time.

13.   (Cancelled)

14.   (Previously presented) The method of claim 11, wherein displaying indications of the amplitudes of displacement of the regions of interest comprises displaying values of the amplitudes in a color-coded manner.

15.   (Previously presented) The method of claim 12, wherein displaying indications of the amplitudes of displacement of the regions of interest, and displaying the indications of the instants of time at which the maximum or minimum of amplitudes of displacements occur in the regions of interest in the respective 2D simplified amplitude representation and the 2D

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simplified phase representation comprises displaying values of the amplitudes and of the instants in time in a color-coded manner.

16.   (Previously presented) A computer-readable storage medium, comprising computer executable instructions for processing ultrasound image data and for displaying an ultrasound image of a deformable 3D organ with indications of the organ wall motions, the computer executable instructions causing an image processing device to:

   acquire image data of an image sequence of the organ under study;

   segment the 3D organ in the images of the sequence for locating the 3D object wall;

   define regions of interest on the segmented 3D organ wall; and

   process the image data to determine the amplitude of displacement of each of said regions of interest as a function of time.

17.   (Previously presented) The computer readable storage medium of claim 16, further comprising computer executable instructions which cause the image processing device to:

   construct a first 2D simplified representation of the 3D segmented organ wall by projection of the 3D segmented organ wall along an axis, wherein projections of the regions of interest are part of the 2D simplified representation; and

   display indications of the amplitudes of displacement of the regions of interest of the 3D segmented organ wall in segments within the constructed 2D simplified representation, wherein the indications are color-coded.

18.   (Previously presented) The computer readable storage medium of claim 16, further comprising computer executable instructions which cause the image processing device to:

   display indications of the maximal or minimal amplitudes of displacement of each of the regions of interest, over a period of time.

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19.   (Previously presented) The computer readable storage medium of claim 16, further comprising computer executable instructions which cause the image processing device to:

construct a second 2D simplified representation of the 3D segmented organ wall, similar to the first 2D simplified representation of the 3D segmented organ wall, this second 2D simplified representation being called 2D simplified phase representation.

20.   (Previously presented) The computer readable storage medium of claim 16, further comprising computer executable instructions which cause the image processing device to:

display indications of the instants of time at which the maximum or minimum of amplitudes of displacements occur in the regions of interest, over a period of time, in said 2D simplified phase representation.

21.   (Previously presented) The computer readable storage medium of claim 16, further comprising computer executable instructions which cause the image processing device to:

display the 2D simplified amplitude representation and the 2D simplified phase representation in a same image at the same time.

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IX. <u>EVIDENCE APPENDIX</u>

None.

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X. <u>RELATED PROCEEDINGS APPENDIX</u>

None known to undersigned attorney/agent.